

Radioactive Waste

Radioactive Waste: Definitions

- High-level radioactive waste - spent reactor fuel or wastes from reprocessed spent fuel.
- Low-level radioactive waste - waste that is not high-level waste or waste that contains transuranics (U, Pu) or uranium or thorium mill tailings.

Low-Level Waste Classification (10 CFR 61.55)

There are three classes of LLW based on the type and concentration of the radionuclides present in the waste:

- Class A – most low level waste is in this category. The concentration of radionuclides is the lowest and it is comprised mostly of radionuclides with short half-lives
- Class B – has concentrations that are greater than Class A but less than Class C
- Class C – has the highest concentration permitted for disposal in a LLRW disposal site. Class C waste has to be enclosed in an intruder barrier system to protect against any inadvertent intruder for at least 500 years

Low Level Radioactive Waste

- **Liquid wastes from fission and activation products in reactor coolant or spent fuel pools**
- **Solid wastes, known as “dry active waste” or DAW from material that became contaminated in the facility, and**
- **Gaseous wastes from fission products**

Liquid Radwaste Treatment

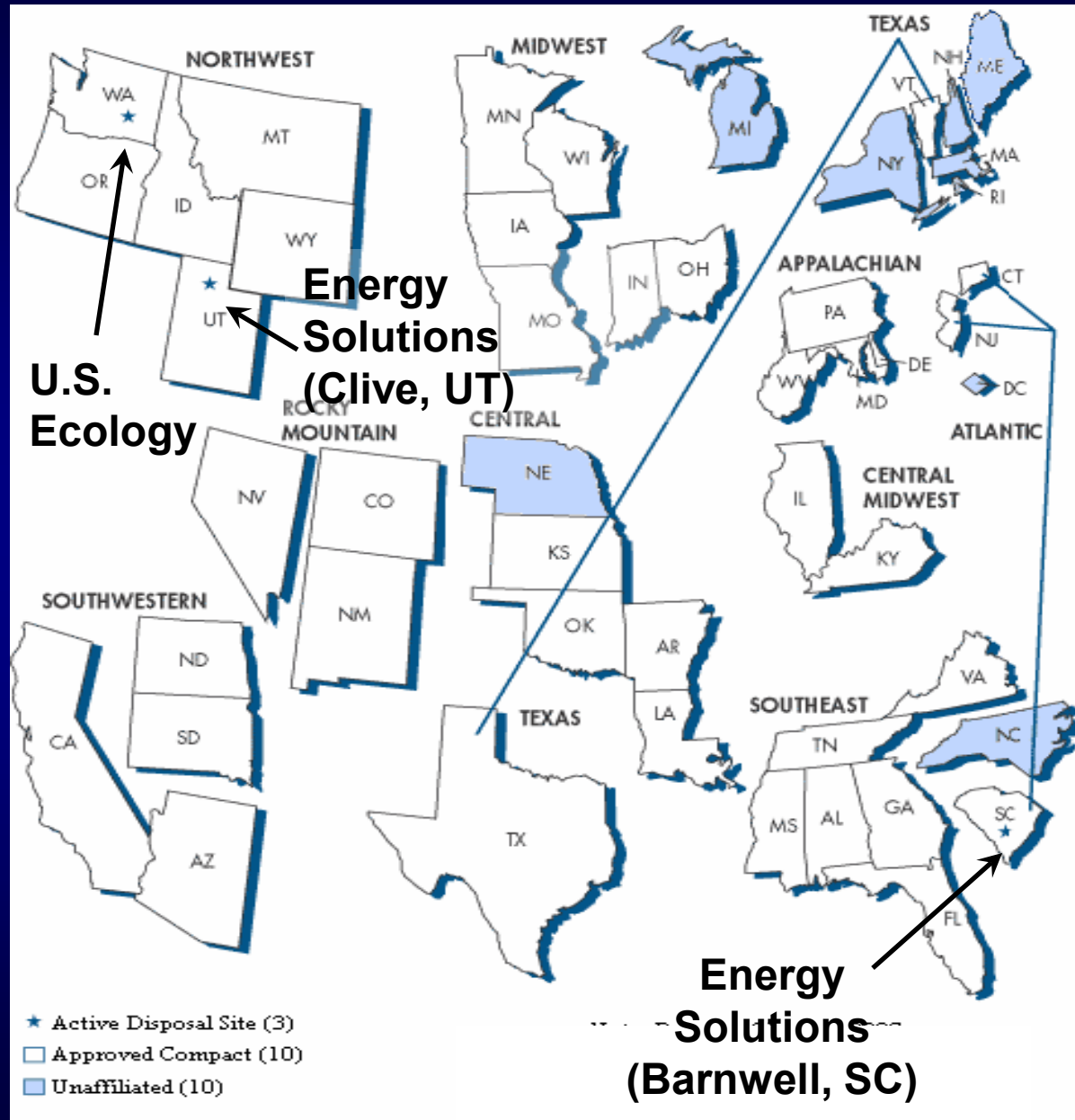
- Wastes containing liquids are dewatered before shipment to a disposal site. Resins used for removing radionuclides in reactor coolant are dewatered in containers called “high integrity containers,” or HICs.
- HICs are placed in transport containers for shipment to a disposal site. At the site they are removed from the shipping container and placed in a concrete vault for burial.
- Dose rates may be up to 5,000 rad/hr.



Low Level Radwaste Disposal



State Compacts



- In 1980, Congress passed the LLRW Policy Act, which established the compact system to encourage states to collaborate in building disposal facilities for LLRW
- Currently, only three disposal facilities are in operation

Waste Disposal - 2008

Disposal Site	Volume Received (ft ³)	Activity Received (Ci)
Energy Solutions (Clive, UT)	2,040,296	4,694
Energy Solutions (Barnwell, SC)	22,278	762,018
US Ecology (Richland, WA)	22,792	16,452
TOTAL	2,085,366	783,164

*** Clive - 98% of the total waste volume**

*** Barnwell - 97% of the total activity**

Entombment of Waste



Dewatered resin containers are being lowered by crane into concrete entombments which provide the stability required for Class B and Class C low-level waste.

Waste Burial



A plastic liner is placed over the disposal site to preclude water intrusion.

Low Level Waste: Current Events



- **Energy Solutions proposal to import low-level radioactive waste from Italy. Waste would be processed in Tennessee and disposed of in Utah.**
- **Barnwell site closed to all but members of the Atlantic Compact in 2008. There are currently no other LLW burial sites open to receive Class B and C waste.**
- **Waste Control Specialists in TX received a license in late 2009 to begin construction of a disposal facility that will receive Class A, B, and C wastes from Texas Compact states.**
- **WCS will begin receiving waste in 2011**

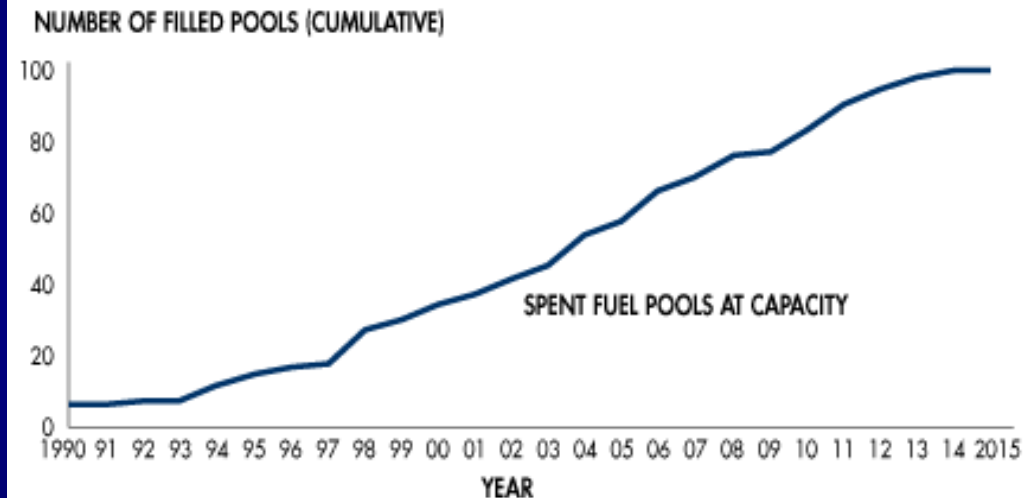
High Level Waste

- **Waste that is greater than class “C” (GTCC) may not be disposed at low-level radioactive waste disposal sites.**
- **Spent reactor fuel is the major source of high level waste.**
- **Spent fuel is currently stored in spent fuel pools and in on-site storage facilities.**

The Full Pool Problem

- **Some of the fuel in a commercial power reactor is replaced every 18-24 months with new fuel**
- **This spent fuel that is removed from the reactor core is placed in underwater storage pools**

Figure 42. Nuclear Fuel Storage Pool Capacity

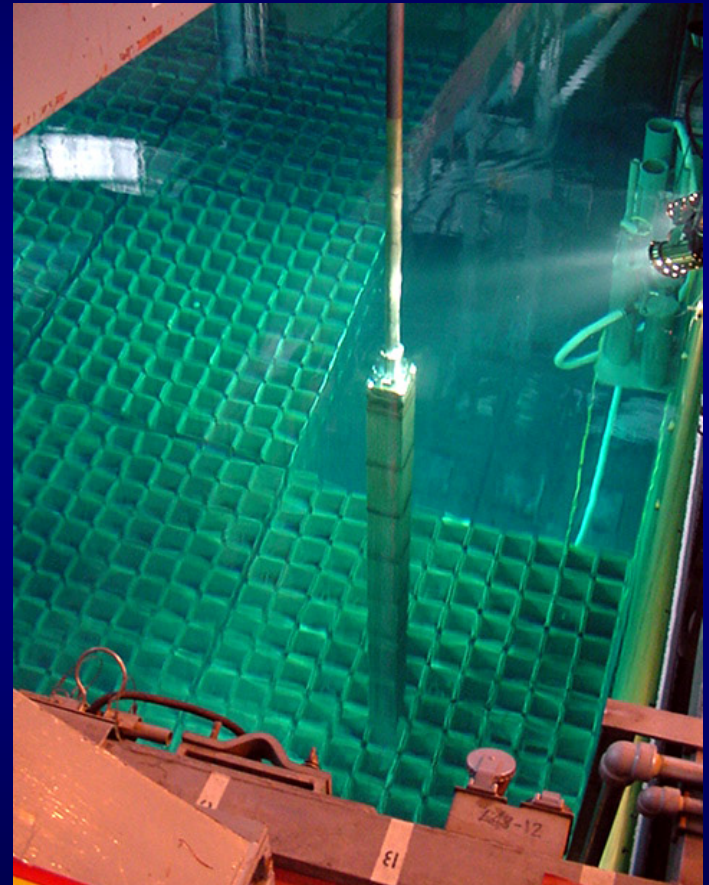


Note: All operating nuclear power reactors are storing used fuel under NRC license in spent fuel pools. Some operating nuclear reactors are using dry cask storage. Information is based on loss of full-core reserve in the spent fuel pools.

Source: Energy Resources International and DOE/RW-0431 – Revision 1

High Level Radwaste

- Disposal of high level waste like spent fuel must be conducted in a geologic repository as specified in 10 CFR Part 60
- Yucca Mountain is discussed in 10 CFR Part 63, “Disposal of High-Level Radioactive Waste At Yucca Mountain, Nevada”



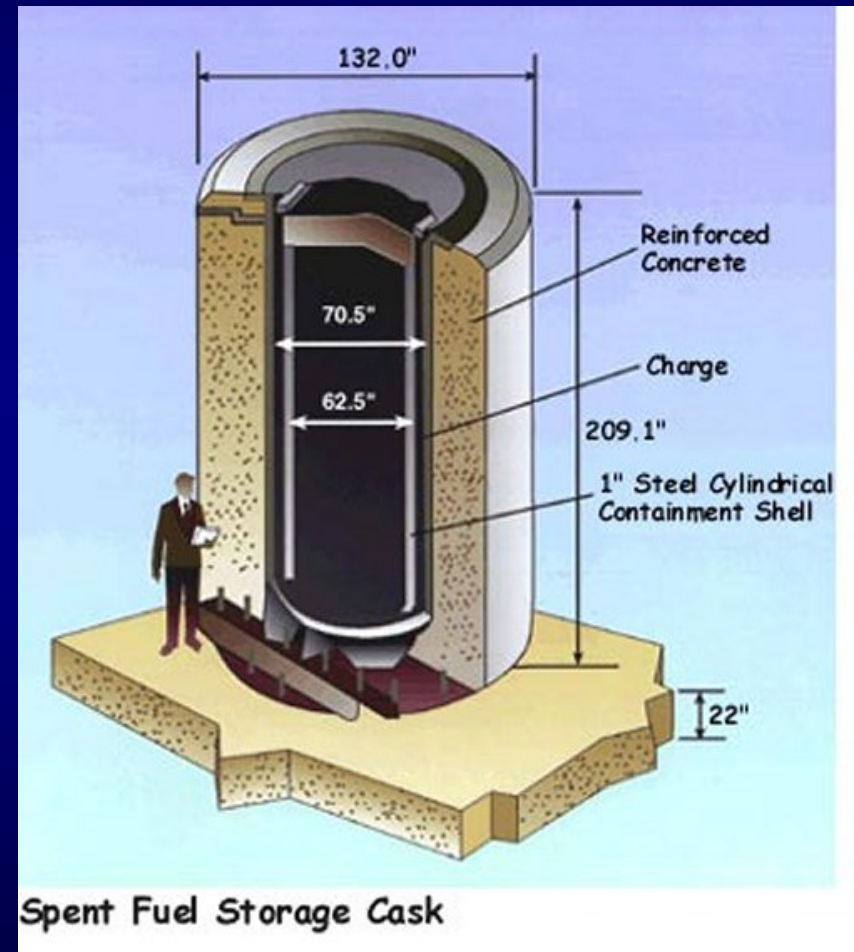
HOWEVER ...

Yucca Mountain?

- **DOE submitted a petition to the NRC on March 3, 2010 to withdraw its license application for Yucca. DOE filed its petition "with prejudice," which would prevent it from being refiled.**
- **NRC's Atomic Safety and Licensing Board denied DOE's motion to withdraw the license application in June 2010.**
- **Energy Secretary Steven Chu announced the formation of a Blue Ribbon Commission on America's Nuclear Future that will provide recommendations on managing used fuel and nuclear waste.**
- **Draft Report due to Secretary of Energy in 2011**

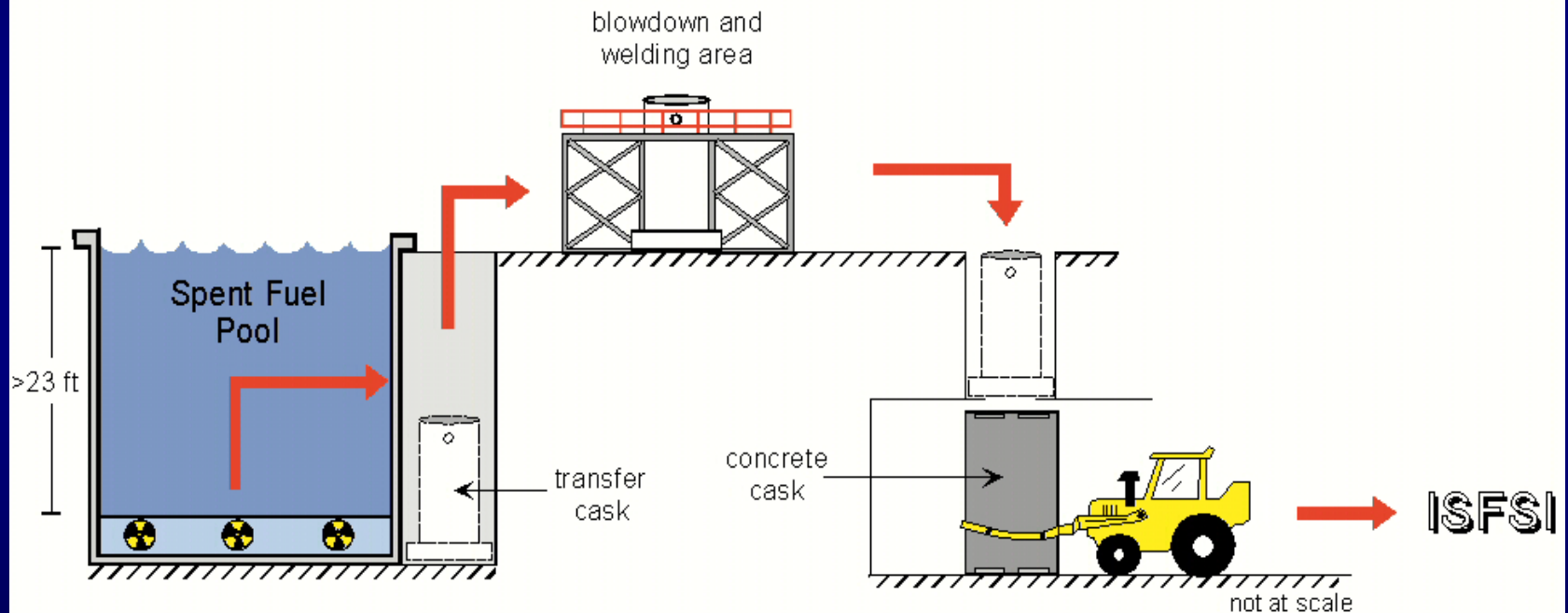
The ISFSI Initiative

- To provide space in spent fuel pools for fuel being removed during outages, “older” spent fuel is taken out of the pool and placed in an Independent Spent Fuel Storage Installation, or ISFSI.
- The storage casks must meet rigorous testing and design requirements.



Spent Fuel Pool Transfer

Trojan's ISFSI Operations



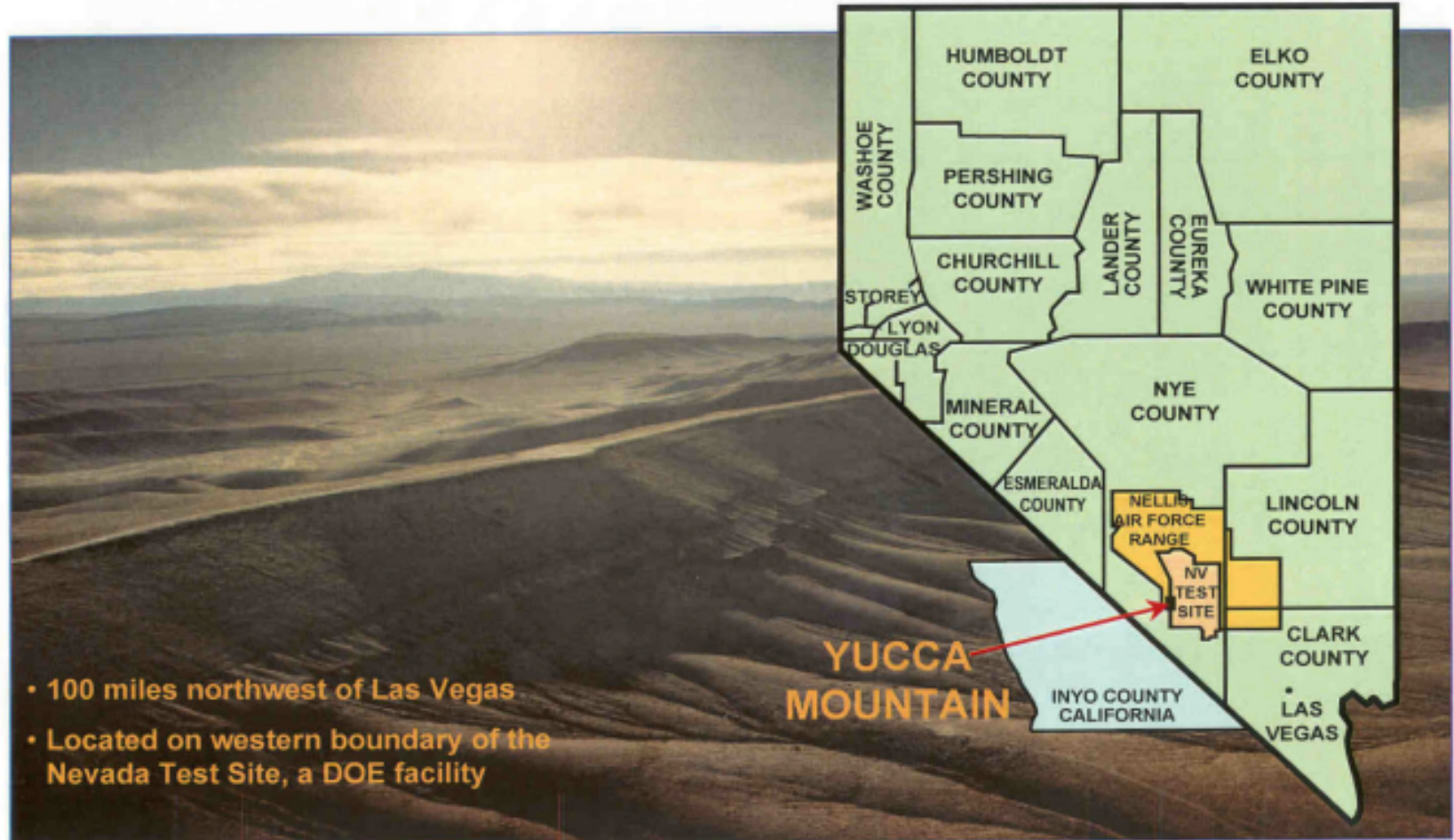
Storage Cask Loading



Storage Configurations

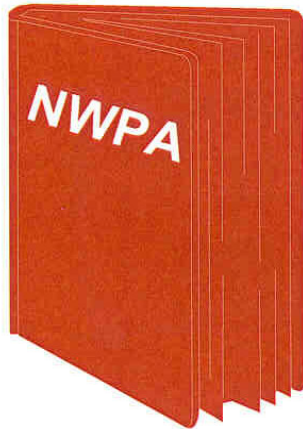


Yucca Mountain



Yucca Mountain: NWPA

1982



- 1982 - Congress established the Nuclear Waste Policy Act (NWPA) for the disposition of high-level radioactive waste and commercial spent nuclear fuel

- 1987 - NWPA as amended eliminated all sites but Yucca Mountain to be characterized for a potential repository



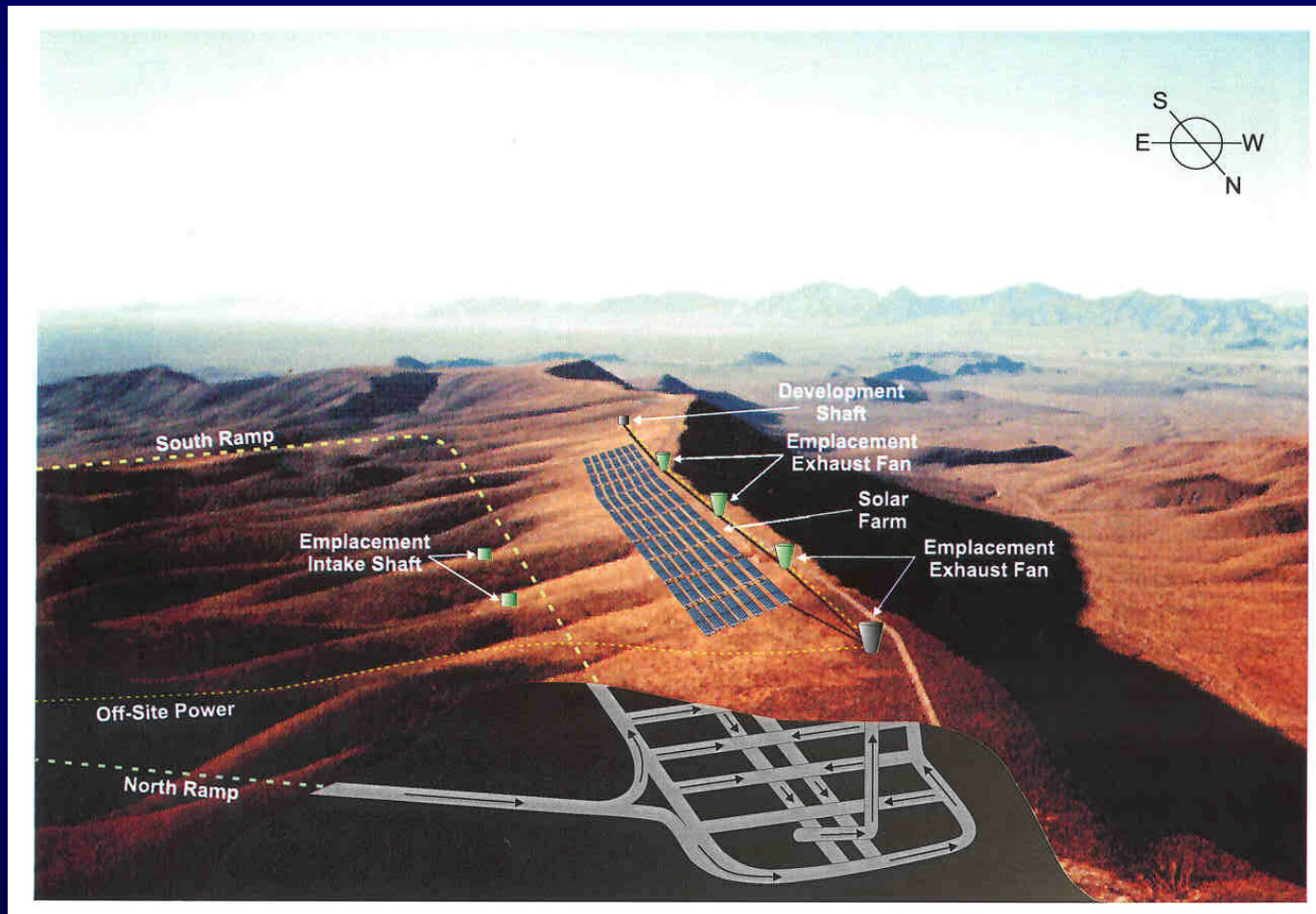
1987

Yucca Mountain

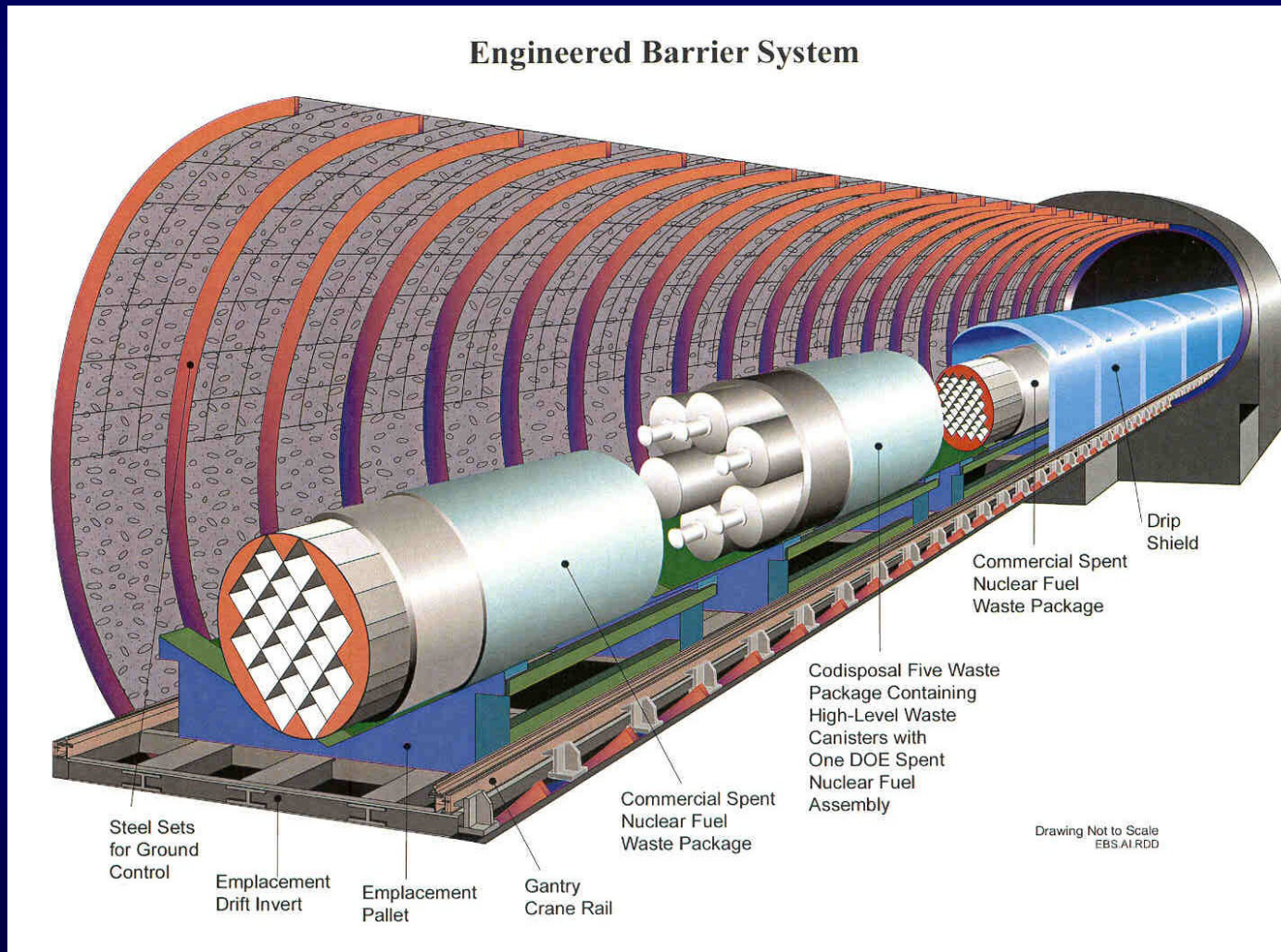
- 90 miles northwest of Las Vegas and adjacent to the Nevada Test site
- Larger than the state of Rhode Island, the Nevada Test Site is approximately 1,375 square miles, making it one of the largest restricted areas in the US
- The site is surrounded by thousands of acres of protected land used as a wildlife range and for military purposes, creating an unpopulated area of some 5,470 square miles.



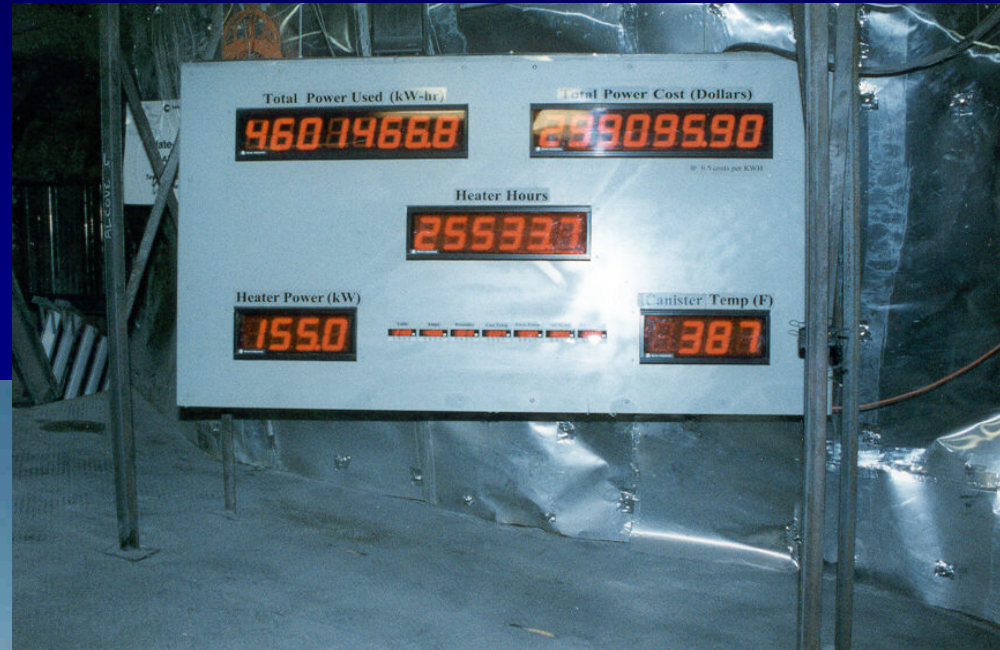
Yucca Engineering Concept



Engineered Barriers



Yucca Mountain



Questions?

END OF RADIOACTIVE WASTE